



Networking for Beginners

Setting up a network isn't as tricky and time-consuming as you might think – and it's incredibly rewarding. **David Ludlow** explains how to get connected and enjoy the benefits of sharing information, settings, an internet connection and more across all the PCs in your home

Many people have more than one PC in their house. Maybe you have a PC and a notebook; it's quite common for each member of the family to have their own PC, too. So why not set up a home network? It may sound a bit geeky and seem like a Herculean task, but it's well worth your while. For one thing you can share a broadband connection and get all your computers online at once – so no more sharing the one PC with fast internet access.

You can also share music and picture files between each PC easily. Without a network, you either have to copy everything to USB keys or burn a CD, which isn't always practical. And if you want to take the kids on at whatever game they're playing, you can do it over a home network. You can also take advantage of the many new network products and services coming out, such as network attached storage (NAS) for sharing disk space between computers, and streaming media products that enable you to play music and video files stored on your PC in the living room (see page 200).

You may know all this already, but dread doing it for yourself. After all, aren't networks those big

scary things that companies pay experts obscene amounts of money to look after? The truth is that networks get complex only when they get large. You can easily install, maintain and manage a home network without too much stress.

Networking is technically easier with cables, but you'll probably want a wireless network too so you can avoid trailing cables all over the house. Wireless networks are a little trickier to configure and much has been written about their insecurity. But a little knowledge goes a long way, and there's no reason why you can't have a secure, reliable wireless network running.

The main problem with networks is the huge amount of jargon involved. Most of it you need never know or worry about, but opposite we highlight the terms you're most likely to encounter. We will give you a rough overview of how everything fits together and step-by-step guides to doing it yourself. If you still get a bit confused by the main text in this feature, you can skip it and follow our set-up tutorials and configuration information for all the common tasks you'll need to perform, including setting up a wireless network.

The type of home network we've suggested isn't the cheapest, but it is the easiest – and it provides everything you'll need as a home user.

WHAT YOU NEED

A network is simply a group of computers connected together using either wired or wireless connections. You can buy all the components separately and configure them manually, but

▼ US Robotics' MAXg Router and PC Card adaptor are ideal for connecting multiple PCs to a broadband modem and each other

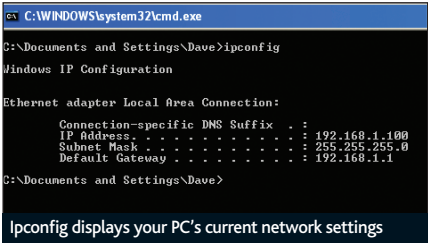


this is a little trickier than we'd like. The simplest method, whether you have a broadband internet connection or not, is to buy a wireless router. These come with four-port Fast Ethernet switches so you can connect up to four PCs via cables, wireless for where cables won't go, and extra technology to make networking easier and to share a broadband connection. One good choice is US Robotics' USR5461 MAXg Router. This router, which costs £77 from www.pcwbusiness.com, has great performance and wireless range. If you have or are planning to buy cable broadband, it will work with the modems supplied by NTL and Telewest.

ADSL users need an Ethernet ADSL modem such as Hayes' ADSL Ethernet Modem (£35 from www.misco.co.uk). The USB modem you may have received when you signed up to ADSL only connects directly to a single PC. As an alternative to a separate ADSL model it's cheaper and often easier if you go for a wireless router with an ADSL modem built in. Ozenda's 11g Wireless ADSL Firewall Router (£63 from www.ozenda.com) fits the bill nicely.

Most new PCs have built-in network ports, but you may find that older ones don't. That's not a problem, though, as a network card that fits into a PCI slot can be bought for as little as £6 from any computer supplier. You'll also need to buy Ethernet cables to connect the PCs to the router.

If your notebook doesn't have built-in wireless, you'll need to buy a separate PC Card adaptor. US Robotics' USR5411 MAXg PC Card adaptor from www.pcwbusiness.com will set you back around £39. If you want to connect a desktop PC wirelessly,



a USB adaptor is ideal. The USR5421 also costs £39 from www.pcwbusiness.com. Cheaper, lower-performance alternatives are also available. To get the wired computers networked, just plug them into the router with Ethernet cables. The wireless clients need a little more work, but our guide on the following page explains how to do it.

NUMBER CRUNCHING

Computers on a network, and indeed the internet, need a unique Internet Protocol (IP) address. Think of this as your computer's phone number. The only way for one computer to communicate with another is if it knows the other's number. IP addresses can be complex to understand and configure unless you know exactly what you're doing. But don't worry; a broadband router immediately takes the strain out of things by providing a Dynamic Host Configuration Protocol (DHCP) server. This handy invention dishes out IP addresses to computers automatically. Here's how it works. Just connect a PC to the router, click on the Start menu and then Run, type

cmd and hit Enter. When the Command Line window appears, type ipconfig and press Enter. You'll get a screen similar to our screenshot on the left. The IP address is your computer's unique address. It's made up of four numbers separated by a full stop, such as 192.168.1.100. If you move to another computer and do the same, you'll notice that the first three numbers stay the same, but the last changes, so you'll get something like 192.168.1.101.

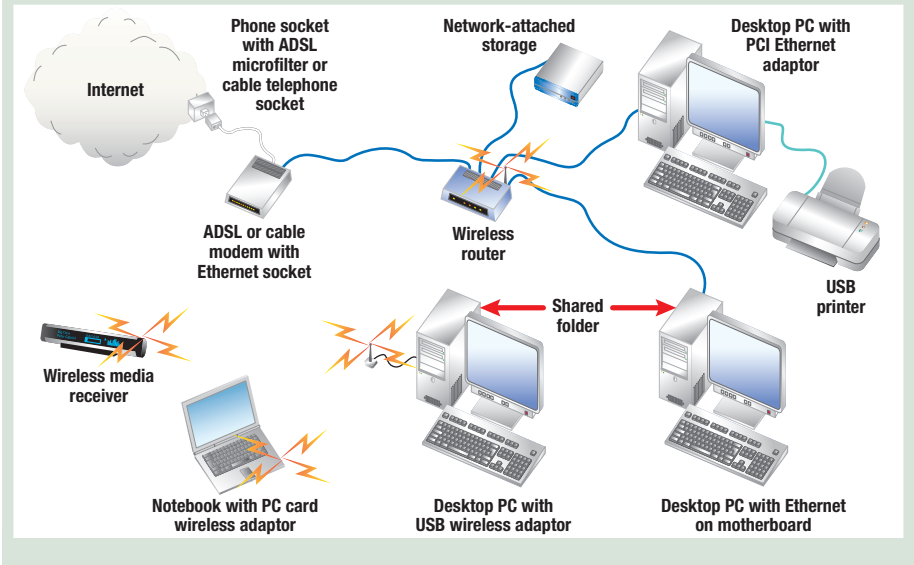
The DHCP server keeps the first three numbers the same and raises the last number sequentially (192.168.1.101, 192.168.1.102, and so on). The maximum is 254 and the minimum is 1, but the actual range assigned depends on settings on the router's control panel, which you can find in your router's manual. For example, if there's a limit of 30 IP addresses and starting address of 192.168.1.100, your router will dish out every address in the range 192.168.1.100 to 192.168.1.129.

WHAT GOES WHERE?

Get yourself acquainted with how a typical home network is set up

Here's how all the devices on a typical home network might be set up. Your wireless router forms the hub of the network and all data passes through it. Don't worry if you haven't got all the other devices shown – all you need is a wireless router and a wired or wireless network interface for each device you want to connect to it. USB printers and storage can also be shared

across a network, but only when the PC they're attached to is switched on. Some of your devices may already have a network interface. Most new PCs have wired networking built in, and many notebooks also come with wireless networking as standard. Network-attached storage and wireless media receivers will have network interfaces built in.



JARGON BUSTER	
ADSL	Asymmetric Digital Subscriber Line: a type of broadband connection that runs over your existing telephone line. Data rates are, on average, 1Mbit/sec.
Ethernet	A type of wired network. Speeds can be either 100Mbit/sec or 1Gbit/sec.
Network	A group of computers and devices that can communicate with each other.
WEP	Wired Equivalent Privacy: a form of encryption that stops people from joining your wireless network without authentication.
Router	A device that connects PCs and lets them share an internet connection.
Switch	A device that lets you connect several devices together in a network, providing guaranteed bandwidth to each one, so each 100Mbit/s device gets 100Mbit/s of bandwidth.
Hub	Precursor to the switch where bandwidth (such as 100Mbit/s) is shared between all devices, impeding network performance.
WiFi	Wireless Fidelity: a standard to ensure interoperability between wireless devices made by different manufacturers.
LAN	Local Area Network: a network over a small area, such as a building.
WAN	Wide Area Network: a network over a wide area, such as the internet, which covers the world.
Firewall	Filters network traffic to protect your PC against attack
MAC address	Media Access Control address: a hardwired address built into all Ethernet devices. It's often used to identify a computer.
IP address	Internet Protocol address. Every computer on the internet has a unique IP address. You can think of it as a computer's phone number.
DHCP	Dynamic Host Configuration Protocol: a way of automatically giving devices a valid IP address.
802.11b	Wireless network standard that operates at 11Mbit/s.
802.11g	Wireless network standard that operates at 54Mbit/s.
SSID	Service Set ID, sometimes known as the Extended (E)SSID: the unique name of a wireless network.

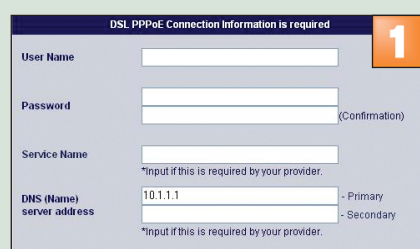


HOW TO... SET UP A WIRELESS ROUTER

To configure your router, you'll need to know its IP address and probably a username and password; the manual should give you this information. If you're using a separate router and broadband modem, you'll need to know the IP address and login details of both devices to access their settings. Configuration must be performed from a wired connection. Once you're physically connected, type the IP address into your web browser and enter the login details when requested to access the settings.

1 Run your modem's setup wizard – or your router's, if it has a modem built in – by following the instructions in your manual. Select the option to receive an IP address automatically from your broadband provider. If you're using ADSL, select PPOA and enter the username and password provided by your ADSL supplier. Cable broadband users need to follow the instructions that came with their connection.

2 If you've never used your broadband connection before, skip this step. If you have, perhaps with a USB modem, go to the PC you connected with, click Start, Run and type cmd. Type ipconfig /all. Find the Physical Address for your PC; this will be six pairs of characters separated by dashes. Under the router's WAN settings, type the same address into the MAC address box, replacing the dashes with colons. This will help you avoid problems if your broadband service is locked to the MAC address of the PC on which it was set up.



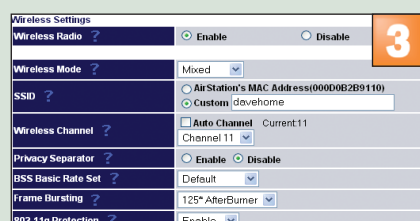
DSL PPPoE Connection Information is required

User Name:

Password: (Confirmation)

Service Name:

DNS (Name) server address: 10.1.1.1 - Primary



Wireless Settings

Wireless Radio: ☒ Enable ☐ Disable

Wireless Mode: Mixed

SSID: Air Station's MAC Address (0000:0B:2B:91:10)

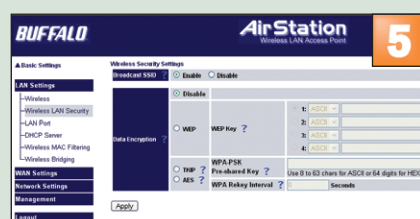
Wireless Channel: Auto Channel Current: 11

Privacy Separator: ☐ Enable ☒ Disable

BSS Basic Rate Set: Default

Frame Bursting: 125% AfterBurner

802.11g Protection: Enable



BUFFALO AirStation Wireless LAN Access Point

Wireless Security Settings

LAN Settings

Wireless LAN Security: ☒ Enable ☐ Disable

WEP Key: 1 2 3 4

WPA-PSK Pre-shared Key:

WPA-PSK Key Type: ☐ WPA-PSK ☐ WPA-2PSK

WPA-PSK Key Length:

WPA-PSK Key Type: ☐ WPA-PSK ☐ WPA-2PSK

WPA-PSK Key Length:

WPA-PSK Key Type: ☐ WPA-PSK ☐ WPA-2PSK

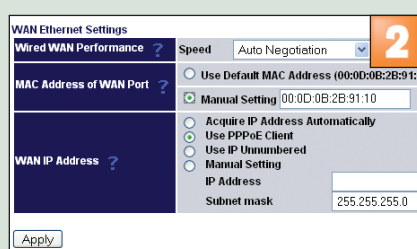
WPA-PSK Key Length:

3 Under wireless settings, type in a name you can remember easily for the ESSID – the name of your wireless network. If your router has it, use auto channel selection. Otherwise, go for 1, 6 or 11, and change between them if you get poor reception. Don't use other numbers, as they are more likely to interfere.

4 Move to a PC that you want to connect to your router wirelessly. If it's the same one you've used so far with a wired connection, unplug the Ethernet cable. Double-click on the wireless icon in your System Tray. A screen should show the name of your network, and possibly others too. Click on your wireless network and click on Connect. Open a web page to test the connection. If it works, you know your wireless connection is working properly.

5 The next step is to turn on the security settings. Reconnect to the router's control panel and click on the Wireless LAN Security (or similar) link. Choose WPA-PSK, AES encryption and type in a new pass phrase. If your router doesn't support WPA-PSK, select 128-bit WEP and go to www.andrewscompanies.com/tools/wep.asp and paste a key into your router.

6 In Windows, click on the Wireless LAN icon in the toolbar. Select your wireless network and, when prompted, type in the WPA-PSK or WEP password to connect. You might discover that your PC doesn't support WPA-PSK. If so, go back to Step 5 and use WEP.



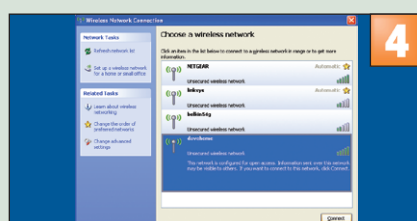
WAN Ethernet Settings

Wired WAN Performance: Speed Auto Negotiation

MAC Address of WAN Port: Use Default MAC Address (00:00:0B:2B:91:10)

WAN IP Address: Manual Setting 00:00:0B:2B:91:10

Subnet mask: 255.255.255.0

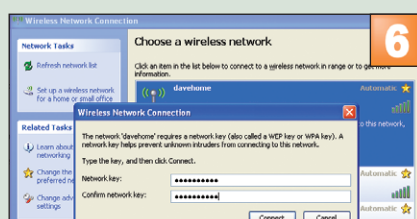


Wireless Network Connection

Choose a wireless network

Available networks:

- Wireless network
- Wireless network
- Wireless network



Wireless Network Connection

Choose a wireless network

Available networks:

- Wireless network
- Wireless network
- Wireless network

The Subnet Mask (255.255.255.0) on your screen looks like another IP address, but it's the same for all computers on the network. This tells your computer which other addresses it can speak to directly, and is useful for logically splitting large networks into more manageable chunks. However, you can ignore it.

Next, your PC is given a default gateway, which is the address of your router and is the same for every PC. When your PC tries to communicate with an IP address outside its own network, your PC passes the request on to the gateway or router. The router understands how to reach external addresses and passes on the information. This is possible only if you have an internet connection.

Finally, your PC is given a domain name server (DNS) address. You can see this by typing ipconfig/all. For your kind of network, it's your router's IP address. It works like this: if you want to visit www.computershopper.co.uk, your computer needs to know the IP address it has to talk to. It gets this by passing www.computershopper.co.uk to its DNS (the router), which looks up the IP address and passes it to your PC.

Write down the Subnet Mask, the default gateway address, the first three digits of the IP address, the DHCP start address and the number of addresses, as you may need them later.

To test that your computer is on the network properly, get a command prompt and type ipconfig. Type 'ping' followed by the default gateway address; if you get a 'Reply from...' message, it's working.



You router's control panel page shows you how many IP addresses it will give out

You can also try pinging the IP address of another computer on the network. First find out its IP address by using the method described above and then, from the first PC, type 'ping' followed by its IP address.

NEW LEASE OF LIFE

There's one problem with automatic IP addresses: leases. A lease states how long a device can have an IP address. When it expires, the IP address is recycled and your PC can get a different one. This is a problem for devices such as network-attached printers, where you need to give it a fixed IP address in order to print.

It's better in these cases to assign IP addresses manually, and you now know all you need to do so. We've written down the gateway address (which is also the DNS address) and the Subnet Mask, so we only need an IP address. Knowing that the first three numbers remain the same and that the final number is in the range of 1 to 254, our IP address has to be in the range 192.168.1.1 to 192.168.1.254. However, it can't be the gateway address and it can't be one given out by the DHCP server; you'll have to check your router's manual and configuration to get this information.



In our example, we can safely use the ranges 192.168.1.2 to 192.168.1.99 and 192.168.1.130 to 192.168.1.254. You can set a PC's IP address by clicking Start, Settings, Control Panel and double-clicking Network Connections. Right-click the active network connection and select Properties. Double-click on Internet Protocol (TCP/IP) and you'll see the windows shown in the screenshot on

```
C:\WINDOWS\system32\cmd.exe
C:\Documents and Settings\Dave>ping 192.168.1.1
Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms
C:\Documents and Settings\Dave>
```

If you get a reply from the Ping command, you know your network is working

the right. For any device you assign manually, write down the address so you don't forget it.

WIRELESS SECURITY

For wired computers connecting to your network, your router can assume they're authorised users. For wireless connections, though, you need to consider security; otherwise your neighbours will be able to join your network. Wireless networks are commonly thought to be complex to configure, but they're not as bad as has been made out. Our walkthrough opposite shows you a typical setup, but it's worth understanding the basics.

First, your wireless network has a Service Set ID (SSID) or Extended Service Set ID (ESSID), which is the network's name. This should be unique and can be anything, so long as you remember what it is. If you tell your router not to broadcast the SSID it can act as a password for your network, but a much better form of security is

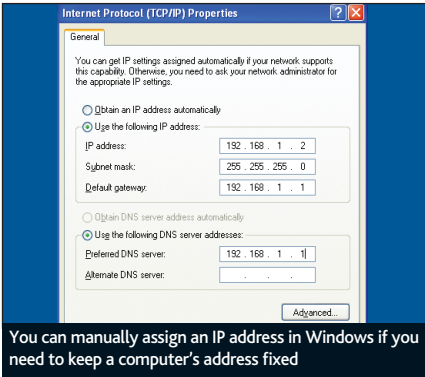
encryption. This stops people using your network without authenticating themselves. If your PCs and router support it, use WPA-PSK. This requires you to enter a password; choose yours carefully.

Otherwise, you must use WEP encryption: we suggest a minimum of 128-bit. Some routers generate the WEP key for you, or you can use www.andrewscompanies.com/tools/wep.asp to do the job for you. Write this key down as you'll need to enter it on every computer.

NETWORKING IT OUT

This introduction to the world of networks should give you all the basic information you need. If you're still a bit confused, the boxes on these pages will guide you through all the common tasks you're likely to perform.

NETWORK CONNECTION STANDARDS			
CONNECTION TYPE	QUOTED SPEED	TYPICAL SPEED	GOOD FOR
Gigabit Ethernet	1Gbit/s (100Mbit/s if connected to a slower speed switch)	850Mbit/s	Large file transfers
Fast Ethernet	100Mbit/s	85Mbit/s	Streaming high-quality video, such as DVD movies
802.11g wireless	54Mbit/s (11Mbit/s if connecting to an 802.11b network)	14Mbit/s close range (6Mbit/s at 25 metres)	Streaming compressed video and music
802.11b wireless	11Mbit/s	6Mbit/s close range (2Mbit/s at 25 metres)	Sharing broadband



HOW TO... SHARE FILES AND PRINTERS

A home network enables you to share files and even printers with other people, allowing you to print from any PC, copy files between PCs and stream music or video across the network. Windows makes this easy to do with just a few clicks in Explorer.

1 Taking each computer on the network in turn, right-click on My Computer and click on Computer Name, then Change. Give each a unique and memorable name, such as 'notebook' or 'david'. You can change the name of the Workgroup, too, but it needs to be the same for every computer on the network. Make a note of all the names.

2 On the computer whose files and printer you want to share, double-click on My Computer and then double-click on the C: drive. Find the folder you want to share (or create a new one), right-click it and select Share from the menu. Click on 'If you understand the security risks...' and in the next dialog box, click 'Just enable file sharing' and then OK. Click 'Share this folder on the network'. It's automatically given the same name as the folder, but you can change this if you want. Put a tick in the 'Allow network users to change my files' box if you want to be able to add and delete files from across the network; otherwise, you'll just be able to access its contents from other computers.

3 To share a printer, open the Control Panel and double-click the Printers icon. Right-click on the printer and select Sharing. Select Share this printer and type in a name for it.

4 Move to another computer on the network, double-click on My Network Places and double-click the computer on which you've set up sharing. If you can't see

the computer, click on Start, then Run and type \\<computername> and press Enter. You'll see your shared printer and folder. Double-click the printer and click OK to install the remote printer. This should happen automatically, and now you can use it in the normal way. Double-click the folder to view the remote files, which will appear a little sluggishly but will work in exactly the same way as any other folder.

